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# Fibril formation of lysozyme upon interaction with sodium dodecyl sulfate at pH 9.2

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**Abstract**

Fibril formation seems to be a general property of all proteins. Its occurrence in hen or human lysozyme depends on certain conditions, namely acidic pHs or the presence of some additives. This paper studies the interaction of lysozyme with sodium dodecyl sulfate (SDS) at pH 9.2, using UV–visible spectrophotometry, circular dichroism (CD) spectropolarimetry, electron microscopy (EM) and chemometry. Based on observations such as the strange increase in absorbance at 650 nm (pH 9.2) and the presence of intermediates, it is assumed that lysozyme fibrils have been formed at pH 9.2 in the presence of SDS as an anionic surfactant. Thioflavin T emission fluorescence and an EM image confirmed this assumption. β-cyclodextrin was then used as a turbidity inhibitor to establish its effect on the distribution of intermediates that participate in fibril formation.


*Keywords:* Lysozyme; Fibril; Sodium dodecyl sulfate; β-Cyclodextrin; Chemometry; Electron microscopy

## 1. Introduction

Self-association and aggregation of proteins are important events in protein folding/unfolding. While advantageous when occurring in blood clotting and muscle fiber formation, in some situations they are associated with a number of diseases such as Alzheimer's disease, Type 2 diabetes, senile amyloidosis, and dialysis amyloidosis. In some of these diseases, the amyloid fibril deposits cause the disease; in others, it is still not established whether the fibrils cause the diseases or are just associated symptoms [1,2]. These diseases are becoming pandemic health problems, as evidenced by apparent advances in human surroundings [3]. Such diseases are caused mainly by conformational changes that lead to a lack of function, generate a toxic activity or form amyloid fibril structures [4]. Amyloid fibrils – regardless of the protein sequence, native structure or native function – are of indeterminate length, unbranched and consist of a common core structure that includes cross β-fibers, with β-strands perpendicular to and β-sheets parallel to the fibril axis [5,6]. It is believed that fibrillation is initiated from an intermediate state, such as partially folded, partially unfolded, molten globule or native-like intermediates and α-helix structures, which then undergo an α/β transition [4].

Formation of amyloid fibrils by lysozyme has recently drawn the attention of many researchers [7,8]. The human type of this enzyme has been found to cause hereditary non-neuropathic systematic amyloidosis [9]. Because of the high similarity in the sequence and structure of hen and human lysozyme, many

*Abbreviations:* SDS, sodium dodecyl sulfate; CD, circular dichroism; EM, electron microscopy; MFC, mole fractions of components; MFI, mole fraction of each intermediate; ThT, thioflavin T

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